THE VETERINARY RECORD

FOUNDED BY WILLIAM HUNTING, F.R.C.V.S., 1888.

No. 20. MAY 31, 1947 VOL. 59.

Observations on the Course and Resolution of Trichomonas foetus Infection in a Group of Heifers

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INTRODUCTION

It is now well established that *Trichomonas foetus* is capable of causing infertility and abortion in cattle and that its transmission is generally venereal. The disease was first reported in this country by Stableforth, Scorgie & Gould (1937) who also summarized the results of previous workers, particularly those in Germany. Kerr & Robertson (1941) and Kerr (1943) have described the condition as it occurs in Northern Ireland. Other accounts of the disease in this country have been given by Gould (1939) and Wright & Arthur (1945). In America, Andrews & Miller (1938) gave an account of the course of events in an infected herd, and Rees & Garlick (1939) and Hammond & Bartlett (1945) described the conditions following experimental infection of groups of heifers. While there is general agreement as to the history, symptoms and course of the disease, points of disagreement occur, particularly concerning its later course and treatment.

The proportion of animals which become infected with *T. foetus* at their initial exposure is not known. About three days after infection vaginitis occurs, accompanied by discharge which may be purulent and always contains numerous and easily detected trichomonads. This discharge usually continues up to the time of the first return to oestrus which may be at three weeks or after a longer interval up to about 30 days. After this, if service by an infected bull is repeated, the cow or heifer continues to return to service regularly at three weeks, or irregularly at intervals which are usually longer than three weeks. During this time the appearance of trichomonads in the vagina is intermittent and difficult to detect. Vaginitis may be present but there is disagreement as to its constancy. After a variable number of infected services conception may occur and the calf be carried to full term or aborted at some time before about twelve weeks, or it may die *in utero* and pyometra supervene, the uterus becoming distended with pus, and the corpus luteum of pregnancy persisting.

The history in cases of trichomoniasis is very similar to that of some other forms of infertility. Consequently, a definite diagnosis can be based only on the recovery of the organisms. The sporadic occurrence of trichomonads in the vagina, and the difficulty of demonstrating them in the male genital tract, has made diagnosis difficult. As prophylaxis involves the slaughter of infected bulls, there is usually some unwillingness to proceed on a tentative diagnosis based on history and symptoms alone.

A blood agglutination test (Kerr & Robertson, 1941) and a skin test (Kerr, 1944) have been evolved to assist in diagnosis, but difficulties have arisen in the interpretation of these tests, first because the blood level of antibody in normal cattle may overlap the lower levels which occur in infected animals, and secondly since serologically different strains of *T. foetus* exist (Kerr & Robertson, 1945).

There is strong presumptive evidence (Andrews & Millar, 1938; Andrews, 1938; Rees & Garlick, 1939) that the disappearance of symptoms and the occurrence of pregnancies when service by infected bulls is continued, may result from the acquisition of specific resistance to *T. foetus* although it has not been possible to develop this resistance artificially (Bartlett, Hammond & Garlick, 1944). It is also believed by some workers that in chronic latent infections exacerbations of the disease may occur, presumably following a breakdown of resistance.

Spontaneous resolution of the disease is said to take place if infected bulls are removed and infected females rested from service for a time (Stableforth *et al.*, 1937; Wright & Arthur, 1945). But the view is also held that spontaneous recovery does not necessarily occur and that treatment of infected animals is required. The various methods of treatment have been reviewed by Stableforth *et al.* (1937). Intra-uterine irrigation with Lugol's solution of iodine is the method usually recommended in this country (Gould, 1939; Kerr, 1943).

To obtain more information concerning the course of the disease the following observations were made on a group of maiden heifers which had been served by infected bulls.

PLAN OF EXPERIMENT AND ANIMALS USED

Sixteen commercial Shorthorn virgin heifers (Group I) were turned out for approximately three months from November, 1943, to February, 1944, with bull "A" which was suspected of being infected with *T. foetus*.

The heifers were then examined *per vaginam* for the presence of *T. foetus*, organisms being found in three animals. One month later, on examining the group *per rectum*, seven animals were diagnosed as pregnant.

Eleven other similar heifers (Group II) were turned out from January, 1944, to April, 1944, with bull "B" which was also suspected of harbouring *T. foetus*. At the end of this time the heifers were examined similarly to Group I and *T. foetus* was found in two animals, three being diagnosed as pregnant.

Bull "A" was killed and the genital tract examined for *T. foetus*. Active organisms were found in easily detectable numbers on the mucous membrane of the glans penis by the method of Hammond & Bartlett (1943). Normal saline washings from the prepuce of bull "B" were found to contain trichomonads.

The three pregnant animals from Group II were added to the whole of Group I to form the "experimental group." The non-pregnant animals were inseminated artificially. Pregnant animals were allowed to go to full term or abort. Three which aborted early were inseminated; two others which aborted later were not inseminated. Rectal examinations were made at intervals to follow the pregnancies from the original bulls, and to detect and follow the pregnancies resulting from artificial insemination. Vaginal examinations were also made at intervals to follow any changes which might occur in the vagina and to detect the presence of *T. foetus*.

By the end of February, 1945, all the animals had calved following service by the original infected bulls or artificial insemination, except two which were still pregnant, two which had aborted late and had not been inseminated, and three which had been culled. On March 5th, 1945, a yearling bull "C," which had never previously been used for service, was turned out with the whole of the group except for the two pregnant animals which were added later. All became pregnant. At the beginning of October, 1945, bull "C" was killed and found to be free from *T. foetus*.

Blood samples were taken in August, 1944, and an agglutination test carried out against *Br. abortus*. This test was negative at all dilutions above the critical titre of 1 in 20.

TECHNIQUES

Vaginal examinations were carried out by dilating the vagina with a Russian pattern "duck-bill" speculum and illuminating the mucous membrane with a vaginal inspection torch. Vaginal mucus present was pulled on to the blade of the speculum, removed and immediately examined microscopically for the presence of trichomonads.

The earliest time at which it was considered that a positive diagnosis of pregnancy could be made was six weeks.

Artificial insemination was performed by rectal manipulation of a glass pipette, and the deposition in the body of the uterus of approximately 1 c.c. of semen diluted with egg-yolk buffer. On some occasions semen collected the same day was used; on others, semen which had been stored at 5° C. in egg-yolk buffer solution. Details of the age of the semen used are given later.

Results

The results can be considered in three parts: (1) The condition of the heifers after they had been exposed to infection from service by infected bulls; (2) The course of events after the infected bulls were removed and the non-pregnant animals were inseminated artificially; (3) The circumstances after they had com-

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pleted a pregnancy or aborted and were served by a non-infected bull.

(1) *Condition of heifers after exposure to infection by natural service.*

The details of the examination of Group I on February 23rd, 1944, and March 24th, 1944, are given in Table I.

TABLE I

RESULTS OF INITIAL RECTAL AND VAGINAL EXAMINATIONS OF GROUP I AFTER EXPOSURE

Number of animal	23.2.44 Vaginal examination +ve = *T. foetus* found	24.3.44 Vaginal examination —ve = *T. foetus* not found	24.3.44 Rectal examination
H. 3	+ve	—ve	Not pregnant
H. 11	+ve	+ve	Pregnant
H. 36	+ve	+ve	Not pregnant
H. 1	—ve	—ve	"
H. 2	—ve	—ve	Pregnant
H. 4	—ve	—ve	Not pregnant
H. 6	—ve	—ve	"
H. 10	—ve	—ve	"
H. 13	—ve	—ve	"
H. 14	—ve	+ve	"
H. 17	—ve	—ve	Pregnant
H. 28	—ve	—ve	"
H. 30	—ve	—ve	"
H. 34	—ve	—ve	Not pregnant
X.144	—ve	—ve	Pregnant
X.145	—ve	—ve	"

Seven of the heifers were diagnosed pregnant. It transpired from later examinations that no others were pregnant following service by bull "A." *T. foetus* was found in the vaginal mucus of three animals on February 23rd, 1944, and in three animals on March 24th, 1944, one which was positive in February (H.3) being negative in March, and one which was negative in February (H.14) being positive in March, and the other two, H.11 and H.36, being positive on both occasions. One of the animals showing organisms on both occasions, H.11, was pregnant; the other three positive animals were not pregnant.

Blood samples were taken from the animals of Group I on two occasions, namely one month and three and a half months after the removal of the infected bull "A." Agglutination tests against *T. foetus* were carried out using strain "Belfast." This strain is of the same type as that found in the outbreak from which the infection of bull "A" was derived.

The results showed seven positives, three above the normal level and six normals, in the samples taken one month after the removal of the source of infection. Table Ia gives the details of the tests in relation to the subsequent history of the animals. The direct observation of *T. foetus* in the vaginal secretion at this period is also included in the table.

TABLE Ia

SHOWING LEVEL OF AGGLUTININS AGAINST *T. foetus* IN BLOOD OF HEIFERS OF GROUP I: ALSO THE ANIMALS FROM WHICH *T. foetus* WAS RECOVERED BY DIRECT EXAMINATION. THE BREEDING RESULTS OF THREE MONTHS IN FIELD WITH INFECTED BULL A ARE GIVEN

	Agglutinins against *T. foetus* in blood: Samples of 24.3.44	Agglutinins against *T. foetus* in blood: Samples of 13.6.44	Animals in which Trichomonas was found by direct examination	Animals producing full time calf to service by infected Bull A	Animals known to have aborted	Animals not pregnant when Bull A removed
H. 1	Above normal	Normal				H. 1
H. 2	Normal	"			H.2 aborted 22.8.44	
H. 3	Positive	Above normal	X			H. 3
H. 4	"	Low positive				H. 4
H. 6	"	Positive				H. 6
H. 10	"	Above normal				H.10
H. 11	"	Positive	X		H.11	
H. 13	Normal	Normal				H.13
H. 14	"	Above normal	X			H.14
H. 17	"	Low positive		H.17		
H. 28	"	Normal		H.28		
H. 30	"	"		H.30		
H. 34	Low positive	Above normal				H.34
H. 36	Positive	Positive	X			H.36
X.144	Above normal	Normal			X.144	
X.145	"	No sample		X.145		
Totals 16	7 positive 3 above normal	5 positive 4 above normal	4	4	3	9

The details of the examination of Group II on May 4th, 1944, are given in Table II.

TABLE II

RESULTS OF INITIAL RECTAL AND VAGINAL EXAMINATION OF GROUP II AFTER EXPOSURE, AND SUBSEQUENT EXAMINATION OF ANIMALS FROM GROUP II NOT USED FOR EXPERIMENT

Vaginal examinations +ve = trichomonads found
—ve = no trichomonads found

21.4.44 Vaginal examination		4.5.44 Vaginal examination		4.5.44 Rectal examination	25.8.44 Rectal examination
S.42	+ve	S.67	+ve	Pregnant	—
		S.39	—ve	Not pregnant	Pregnant
		S.50	—ve	"	Not pregnant
		S.53	—ve	Pregnant	—
		S.54	—ve	Not pregnant	Pregnant
		S.55	—ve	"	Not pregnant
		S.56	—ve	"	Pregnant
		S.66	—ve	"	"
		S.68	—ve	"	"
		S.84	—ve	Pregnant	—

One heifer, S.67, showed organisms and was pregnant; two others, S.84 and S.53, were pregnant. One heifer, S.42, had previously shown organisms on April 21st but between that date and May 4th she was culled and slaughtered and no information was available as to whether or not she was pregnant as no rectal or *post-mortem* examination could be made. The remaining seven heifers were either "empty" or were not sufficiently advanced in pregnancy for it to be detected by rectal examination. They were not included in the experimental group. Subsequently it was found that five of them were pregnant.

Thus, forming the experimental group there were 19 heifers, which had been exposed to infection and from five of which trichomonads had been recovered.

(2) *Observations after removal of infected bulls. Artificial insemination of non-pregnant heifers.*

The second part of the experiment, during which the empty heifers were inseminated after the whole group had been separated from the infected bulls, is summarized in Table III.

TABLE III

DETAILS OF THE HISTORIES AND VAGINAL AND RECTAL EXAMINATIONS OF THE EXPERIMENTAL GROUP DURING PART 2 OF THE EXPERIMENT

P.V. = Vaginal examination. +ve = trichomonads found. —ve = no trichomonads found.
P.R. = Rectal examination. +ve = pregnant. —ve = not pregnant.

No. of animal		Dates of examinations: 19.4.44	13.6.44	21.7.44	23.8.44	13.10.44	9.1.45	15.2.45
H. 1	P.V.	—ve	—ve	—ve		Culled		
	P.R.	—ve	—ve	—ve				
		Inseminated 19.4.44						
H. 2	P.V.	—ve	—ve	—ve	+ve	—ve	—ve	—ve
	P.R.	+ve	+ve	+ve				
		In calf to original infected bull A. Aborted 22.8.45						
H. 3	P.V.	—ve	—ve	—ve	—ve	—ve	—ve	—ve
	P.R.	—ve	+ve	+ve	+ve	+ve	+ve	
		Inseminated 6.4.44, 29.4.44					Calved 29.1.45	
H. 4	P.V.	—ve	—ve	—ve	—ve	—ve	—ve	—ve
	P.R.	—ve	—ve	+ve	+ve	+ve	+ve	+ve
		Inseminated 22.3.44, 29.4.44, 18.5.44					Calved 25.2.45	
H. 6	P.V.	—ve	—ve	—ve	—ve	—ve	—ve	—ve
	P.R.	—ve	+ve	+ve	+ve	+ve		
		Inseminated 16.3.44				Calved 26.12.44		
H. 10	P.V.	—ve	—ve	—ve	—ve	—ve	—ve	—ve
	P.R.	—ve	+ve	+ve	+ve	+ve		
		Inseminated 20.3.44				Calved 30.12.44		
H. 11	P.V.	+ve	+ve	+ve	—ve	—ve	—ve	—ve
	P.R.	+ve	+ve	+ve				
		In calf to original infected bull A. Aborted between 21.7.44 and 23.8.44						
H. 13	P.V.	—ve	—ve	—ve	—ve	—ve	—ve	—ve
	P.R.	—ve	—ve	+ve	+ve	+ve	+ve	
		Inseminated 17.3.44, 14.4.44, 10.5.44					Calved 15.2.45	
H. 14	P.V.	—ve	—ve	—ve				
	P.R.	—ve	—ve	—ve		Culled		
		Inseminated 19.4.44, 16.6.44						
H. 17	P.V.	—ve	—ve	—ve	—ve	—ve	—ve	—ve
	P.R.	+ve	+ve	+ve	+ve			
		In calf to original infected bull A. Calved 23.9.44						

No. of animal		Dates of examinations						
		19.4.44	13.6.44	21.7.44	23.8.44	13.10.44	9.1.45	15.2.45
H. 28	P.V.	—ve	—ve	—ve	—ve	—ve	—ve	—ve
	P.R.	+ve	+ve	+ve	+ve			
		In calf to original infected bull A. Calved 15.9.44						
H. 30	P.V.	—ve	—ve	—ve	—ve	—ve	—ve	—ve
	P.R.	+ve	+ve	+ve	+ve			
		In calf to original infected bull A. Calved 3.9.44						
H. 34	P.V.	—ve	—ve	—ve	—ve	—ve	—ve	—ve
	P.R.	—ve	+ve	+ve	+ve	+ve	+ve	
		Inseminated 27.3.44					Calved 11.1.45	
H. 36	P.V.	—ve	—ve	—ve	—ve	—ve	—ve	—ve
	P.R.	—ve	+ve	+ve	+ve	+ve	+ve	
		Inseminated 19.4.44					Calved 29.1.45	
X.144	P.V.	—ve	—ve	—ve				
	P.R.	—ve	—ve	—ve				
		In calf to original infected bull A. Aborted between 24.3.44 and 19.4.44. Inseminated 28.4.44, 16.6.44. Culled.						
X.145	P.V.	—ve	—ve	—ve	—ve	—ve	—ve	—ve
	P.R.	+ve	+ve	+ve	+ve	+ve		
		In calf to original infected bull A. Calved 23.11.44						
			13.6.44	21.7.44	23.8.44	13.10.44	9.1.45	15.2.45
S. 53	P.V.		—ve	—ve	—ve	—ve	—ve	—ve
	P.R.		—ve	—ve	—ve	+ve	+ve	+ve
		In calf to original infected bull B. Aborted 27.5.44. Inseminated 24.7.44, 14.8.44, 4.9.44. Calved 23.6.45						
S. 67	P.V.		—ve	—ve	—ve	—ve	—ve	—ve
	P.R.		—ve	—ve	—ve	—ve	+ve	+ve
		In calf to original infected bull B. Aborted between 4.5.44 and 13.6.44. Inseminated 18.8.44. Calved 31.5.45						
S. 84	P.V.		—ve	—ve	—ve	—ve	—ve	—ve
	P.R.		+ve	+ve	+ve	+ve		
		In calf to original infected bull B. Calved twins 11.11.44						

After the examinations on February 2nd and March 24th, 1944, in the case of animals from Group I, and April 21st and May 5th, 1944, in the case of animals from Group II, no positive vaginal samples were obtained except from H.11 and H.2, the whole experimental group being examined on the dates shown in Table III. H.11 was positive at the original examination and trichomonads were seen at every subsequent examination until, in July, 1944, she aborted a foetus aged approximately seven months. The foetal stomach and membranes contained numerous trichomonads. No more positive vaginal samples were found after abortion and the uterus returned rapidly to the normal non-pregnant condition. H.2 was in-calf to the original infected bull "A" and trichomonads had never been seen in her vaginal mucus nor was any other abnormality noticed. On August 22nd she aborted a foetus aged approximately seven months, the stomach and membranes of which contained trichomonads. The following day large numbers of trichomonads were found in discharge from her uterus. After this, the uterus rapidly returned to the normal non-pregnant state and *T. foetus* was never found again in her vaginal mucus. These two animals, H.11 and H.2, were not inseminated but were examined periodically with the rest of the group (Table III). They had normal oestrous cycles.

Of the remaining five animals pregnant to bull "A," one, X.144, aborted between March 24th and April 19th, 1944. Trichomonads were never recovered from this animal and it was not possible to examine the foetus. She remained negative after abortion and was artificially inseminated. The other four heifers, H.17, H.28, H.30 and X.145, from which trichomonads were never recovered, carried their calves to full term.

Of the three animals from Group II which were pregnant to bull "B," one, S.53, aborted on May 27th and another, S.67, between May 4th and June 6th, 1944. It was not possible to examine the aborted foetuses for trichomonads. In both cases the uterus rapidly returned to normal and both were inseminated. The remaining heifer, S.84, carried her calf to full term.

The nine heifers which were not in-calf to bull "A" or "B," and the three which aborted at an early stage, X.144, S.53 and S.67, were artificially inseminated. Details at the dates of insemination and the age of the semen used are given in Table IV.

Five animals became pregnant after one insemination, one animal after two inseminations, three after three inseminations, and three, H.1, H.14 and X.144, were culled from the group in August before it was known whether or not they were pregnant. H.1 had been inseminated on April 19th, H.14 on April 19th and June 16th and X.144 on April 28th and June 6th. Between the last date of insemination and the beginning of August they had not been seen in oestrus, were clinically normal, but had not been diagnosed pregnant and the owners of the animals disposed of them. The over-all insemination-conception ratio, including as not pregnant the animals which were disposed of, was 2·3. If the animals disposed of are considered pregnant, the ratio was 1·8.

TABLE IV

GIVING DETAILS OF THE DATES OF INSEMINATIONS AND THE AGE OF THE SEMEN USED DURING PART 2 OF THE EXPERIMENT

Number of animal	Date of insemination	Age of semen (hours)
H. 1	19.4.44	54
H. 3	6.4.44	—
	29.4.44	48
H. 4	22.3.44	50
	20.4.44	48
	18.5.44	6
H. 6	16.3.44	2
H. 10	20.3.44	2
H. 13	17.3.44	53
	14.4.44	4
	10.5.44	3
H. 14	19.4.44	54
	16.6.44	50
H. 34	27.3.44	75
H. 36	19.4.44	54
X.144	28.4.44	60
	16.6.44	—
S. 53	24.7.44	116
	14.8.44	120
	4.9.44	2
S. 67	18.8.44	26

By the end of February, 1945, the position in the experimental group of 19 animals can be summarized as follows: of ten animals originally pregnant to bulls "A" and "B," five had aborted, three (X.144, S.53 and S.67) at about three months and two (H.2, H.11) at about seven months; of these, two (S.53, S.67) were pregnant to insemination, one had been disposed of (X.144), and the two which aborted at about seven months (H.2, H.11) had not been inseminated. The remaining five (H.17, H.28, H.30, X.145, S.84) had produced healthy calves at full term without incident. The nine empty animals (H.1, H.3, H.4, H.6, H.10, H.13, H.14, H.34, H.36) had become pregnant and calved without incident following artificial insemination, except for two animals (H.1, H.14) which were disposed of. No trichomonads had been seen since one month after separation from the infected bulls except in two pregnant animals (H.2, H.11), both of which aborted.

The two heifers, S.67 and S.53, which had aborted, calved at full term on May 31st and June 21st, 1945, no trichomonads being seen during pregnancy. Delivery of the calf from S.67 had to be assisted and that from S.53 was born dead. No trichomonads were found in the calf or in the maternal discharges.

(3) *Condition following service by an uninfected bull.*

At the beginning of March, 1945, the third part of the experiment was commenced. A yearling bull "C" which had never previously been used for service was put with the experimental group excepting S.67 and S.53 which were still pregnant, which calved respectively on May 31st and June 21st and which were added to the rest of the group on July 31st. The delay was due to the fact that S.67 showed slight uterine discharge during the first six weeks and S.53 during the first month *post partum*. At parturition S.67 had to be assisted. When stained smears of the uterine discharge were examined, bacteria with the morphology of *Corynebacterium pyogenes* were found. No trichomonads were found. S.53 calved a dead calf at full term. No trichomonads could be found in the foetal membranes or stomachs. In both cases the discharge ceased spontaneously.

During the time that bull "C" was with the experimental group the periodical examinations were recommenced, beginning 50 days after the bull was first put with the herd (Table V overleaf).

Both vaginal and rectal examinations were made on the first four occasions at monthly intervals. There was an interval of two months between the fourth and fifth examination. At the sixth examination S.67 and S.53 only were examined *per rectum*. After 50 days seven animals were 42 days or more pregnant, after 79 days eight were pregnant, after 109 days eleven, 13 after 141 days, 14 after 190 days, and in October the remaining two animals, S.53

TABLE V

RESULTS OF THE RECTAL EXAMINATION OF THE "EXPERIMENTAL GROUP" DURING PART 3 OF THE EXPERIMENT

No of animal	25.4.45	23.5.45	22.6.45	24.7.45	11.9.45	17.10.45
H. 2	Pregnant	Pregnant	Pregnant	Pregnant	Pregnant	Not examined
H. 11	"	"	"	"	"	"
H. 13	"	"	"	"	"	"
H. 17	"	"	"	"	"	"
H. 18	"	"	"	"	"	"
H. 30	"	"	"	"	"	"
S. 84	"	"	"	"	"	"
X. 145	Not pregnant	"	"	"	"	"
H. 3	"	Not pregnant	"	"	"	"
H. 4	"	"	"	"	"	"
H. 34	"	"	"	"	"	"
H. 10	"	"	Not pregnant	"	"	"
H. 36	"	"	"	"	"	"
H. 6	"	"	"	Not pregnant	"	"
S. 53	Calved to insemination (see Table IV) June 21st			Both turned with bull C 31.7.45	Not pregnant	Pregnant
S. 67	Calved to insemination (see Table IV), May 31st				"	"

Vaginal examinations were made on all the dates at which rectal examinations were made. No trichomonads were ever found.

and S.67, which had not been put with the bull until July 31st, were also pregnant. No trichomonads were seen at any examinations. On October 9th, 1945, bull "C" was killed and the genital tract searched for trichomonads, the penis and prepuce being examined by the method of Hammond & Bartlett (1943). No trichomonads were found.

Occurrence of Endometritis and Vaginitis

At no stage during the course of the experiment was there any evidence of endometritis due to *T. foetus* infection in the non-pregnant animals. No uterine abnormality was palpable *per rectum*, nor was any enlargement or inflammation of the cervix or vagina visible *per vaginam*. Vaginal mucus which was more copious and contained a larger number of cells than normal was occasionally encountered. The animals which were pregnant and later aborted were, with the exception of H.11, normal both at rectal and vaginal examination. In the case of H.11 mucopurulent material containing trichomonads was found in the vagina at every examination till abortion. After this she became normal. The other animals which aborted also returned to the normal non-pregnant state very quickly. There was no evidence of permanent damage having been done to the reproductive tract.

DISCUSSION

If a normally fertile bull is put with a group of normal maiden heifers a very high fertility rate usually results, and it can be expected that at the end of about two months all the heifers will be pregnant. The initial stage of the above-described experiment gives a picture of what can occur after a group of heifers has been served by a bull infected with *T. foetus*. Considering Groups I and II together, after three months' access to the bull, 15 of 27 animals were pregnant. (The remaining animal, S.42, was culled before it was known whether or not she was pregnant.) Thus approximately 60 per cent. were pregnant instead of the normally expected 100 per cent. Five of these heifers aborted later. It is of interest to note that two aborted at about seven months, a time which is more usually associated with *Br. abortus* than *T. foetus* infection. Although these observations confirm that infertility follows *T. foetus* infection, they give no precise information as to why some animals within an exposed group become pregnant without difficulty while some conceive but abort, and others do not conceive. There must of course be considerable variation in the response to infection, depending on the individual animal and the number and infectivity of organisms present. The time (calculated from their calving dates) during which those heifers which were initially pregnant, and subsequently did not abort, were with the bulls before they conceived was approximately three, six, seven, eight and twelve weeks for S.84, H.28, H.17, H.30 and X.145 respectively. Compared with the results of Andrews & Millar (1938) and Rees & Garlick (1939) this provided a very short time in which to acquire a sufficient degree of resistance for normal pregnancy to occur. In their animals conception took place only after a prolonged period of infertility with successive infected services. While this short period of exposure before conception in our animals does not rule out the possibility that they had rapidly reached a high level of specific resistance to *T. foetus*, it raises the question of whether they were naturally refractory to infection or whether organisms were being transmitted at every service by the infected bulls.

It is to be noted that the infection could have been diagnosed by means of the agglutination test (Table IA).

The variation in the number of positive vaginal samples obtained from the experimental group at different examinations soon after infection, and the fact that at successive examinations the same animal was negative then positive without intermediate infection, support the view that trichomonads are not always present in the vaginal mucus of infected animals. Inability to demonstrate trichomonads in vaginal mucus from infected animals may be due in part to the numbers of organisms present being so small and their activity so slight that they are not seen at an immediate direct examination made under field conditions. An increased number of positives has been obtained by later examination of incubated material (Andrews & Millar, 1938; Rees & Garlick, 1939). But in view of the evidence (Rees & Garlick, 1939; Gould, 1939; and Hammond & Bartlett, 1945) that the trichomonads made a periodic appearance in the vagina in relatively large numbers towards the end of the oestrous cycle, it appears that the chief factor influencing the recovery of organisms is the relationship of the time of examination to the time of oestrus. It would seem that in attempting to make a diagnosis there is little point in examining animals in the early stages of the cycle as trichomonads are then absent, and that if the examinations are confined to those animals which have reached the last two or three days of the cycle, recovery of organisms is much more likely.

After the 56 days from February 24th to April 19th, 1944, that is, the equivalent of two to three oestrous cycles, trichomonads could not be recovered from the non-pregnant heifers. Nor could they be recovered from infected pregnant animals after abortion. These facts when considered with the high rate of fertility following insemination, the absence of any symptoms of trichomoniasis during Parts 2 and 3 of the experiment and the failure to find trichomonads in bull "C" at *post-mortem* examination, suggest that the infection had resolved spontaneously. This opinion is weakened by the absence of definite information as to whether or not H.1, H 14 and X.144 became pregnant to insemination. These animals were culled by the owners because they had not been seen in season after insemination. They had been examined *per rectum*, were normal, but had not gone sufficiently long from insemination for pregnancy to be diagnosable. Anoestrum is uncommon amongst healthy cattle at pasture in the summer-time and the only case in which it is known to result from *T. foetus* infection is in pyometra, and of this there was no evidence in these three animals. It seems most likely that they did not show oestrus because they were pregnant.

The case is further weakened by the fact that it was not possible to have H.2 and H.11 artificially inseminated as they aborted so late, and they were not given the opportunity to conceive till served by the clean bull "C" in the third stage of the experiment. But it is strengthened by the ease with which S.67 and S.53 conceived after abortion. S.67 required only one insemination; S.53 was inseminated three times, but on the first two occasions semen aged 116 and 120 hours was used. When semen collected the same day was used she conceived.

While bull "C" was with the herd in the third part of the experiment, some delay in conception occurred. Approximately four and a half months elapsed from the time the bull was put with the first 14 animals before all conceived. But during part of this time he was in extremely poor physical condition and his fertility may have been impaired. At the same time he was unmanageable and it was not possible to collect samples of semen from him in order to assess his fertility.

It may be that the non-recovery of trichomonads was due to the limitations of the method of examination. Small numbers of inactive organisms could certainly not have been found by the methods used. If the cultural methods now available (Mahmoud, 1945) had been employed, more definite information might have been obtained. But the apparent absence of organisms coupled with the other evidence suggests that when re-infection ceased the disease resolved spontaneously.

This can be correlated with what is known of the conditions and times when trichomonads may be regularly and easily recovered from infected animals. They are demonstrable continuously for long periods in the vaginal discharge of animals with pyometra (Stableforth *et al.*, 1937; Rees & Garlick, 1939; Wright & Arthur, 1945), can be found, sometimes continuously, sometimes sporadically,

in the vaginal discharge from infected pregnant animals (Day, 1942; Kerr, 1943), and regularly in the membranes and stomachs of aborted foetuses (Stableforth *et al.*, 1937). There is some dispute concerning the times when organisms leave the uterus and can be found in the vaginal discharges of non-pregnant animals after the initial multiplication in the vagina following infection. But it seems most likely that they are present during the last few days of the cycle, disappear during oestrus and remain absent till the end of the next cycle (Gould, 1939; Rees & Garlick, 1939; Hammond & Bartlett, 1945). Apparently, after the initial vaginal multiplication, the organisms colonize within the uterus, and provided that re-infection does not occur, are expelled during pro-oestrum at successive cycles till none is left (Hammond & Bartlett, 1945). An explanation for this latter, based on a suggested differential resistance of different parts of the female genital tract, was put forward by Hammond & Bartlett (1945). But although specific acquired resistance may play a part in the discharge of trichomonads from the uterus, it is apparent also that when the trichomonads are colonizing the uterus, that is during pregnancy, pyometra or mid-cycle, an active corpus luteum is always present. When the corpus luteum regresses at abortion or at the end of the oestrous cycle, or if it is expressed manually or its regression induced in pyometra, the trichomonads leave the uterus. It appears likely that the endometrium under the influence of the corpus luteum and therefore of progesterone provides a medium which is suited to the trichomonads' physiology, and that when the luteal phase of the cycle is past, or the corpus luteum of pregnancy is no longer active, the medium is unfavourable. It may simply be that the quiescent uterus allows the trichomonads to colonize, and the uterus which is motile under the influence of oestrogens rids itself of them with the mucus at oestrus. Or it may be that the oestrogens have some specific toxic action on the trichomonads.

If precise information were available on the time taken for the disease to resolve spontaneously in non-pregnant animals having oestrous cycles, the management of outbreaks of trichomoniasis could be considerably simplified. No treatment would be necessary except cessation of service for the necessary time, treatment of cases of pyometra and disposal of infected bulls. The observations described here suggest that resolution occurs fairly rapidly, but in other cases infection may remain longer. Where artificial insemination can replace natural service the point is of less importance. But even where this is possible natural breeding must be recommenced as soon as possible in many herds. It is essential to know when this can be done without the risk of clean bulls becoming infected.

Information is also necessary on the likelihood of females retaining infection after a normal pregnancy. It has been stated by some workers that this is one means by which the disease is perpetuated in a herd. This is not in agreement with the evidence, which suggests a connection between the trichomonads' ability to colonize permanently in the uterus and the continued presence of an active corpus luteum. The fact that *T. foetus* rarely causes permanent damage to the reproductive tract except in long-standing cases of pyometra supports the view that it should perhaps be regarded as a parasite of the developing embryo and foetus rather than of the reproductive tract itself. But the evidence is mainly circumstantial and requires further support from experimental work before it can be fully accepted. It would be of interest to determine how far infection could be maintained in females under continuous progesterone or oestrogen treatment, and under alternations of these treatments. It might also be of value to determine whether there is any analogy between the condition of the surface of the endometrium under luteal influence and that of the epithelium of the prepuce and glans penis where trichomonads seem to be able to live indefinitely.

Summary

1. Twenty-six maiden heifers were exposed to *T. foetus* infection from service by infected bulls.

2. After about three months they were separated from the bulls. Fifteen were pregnant, five of which aborted and ten went to full term.

3. Nineteen of these heifers were used for experiment, ten of them being pregnant.

4. They were examined at monthly intervals *per vaginam* and *per rectum*. Non-pregnant heifers and two of those which aborted were artificially inseminated.

5. All the inseminated animals conceived without difficulty except three which were culled before it was definitely known whether or not they were pregnant.

6. No evidence of *T. foetus* infection was seen from two months after the time the heifers were separated from the bulls, except in pregnant animals which aborted. No infection could be found in those after abortion. The disease appeared to have resolved spontaneously.

7. After all the animals had calved or aborted following service by the infected bulls, or following artificial insemination, they were put with an uninfected bull, when they all became pregnant. There was no evidence of *T. foetus* infection in the bull at *post-mortem* examination.

8. The possibility of the spontaneous resolution of the disease in animals having oestrous cycles after the source of infection has been removed, and in pregnant animals after parturition or abortion, is discussed in relation to the apparent ability of the trichomonads to colonize in the uterus only while an active corpus luteum is present.

Acknowledgments.—This work was carried out under the supervision of Professor T. Dalling, to whom we are indebted for help and encouragement. The agglutination tests against *T. foetus* were carried out by Dr. M. Robertson, F.R.S., of the Lister Institute, the benefit of whose collaboration we had throughout the course of the observations. We must thank also Mr. M. O. J. McCarthy of the Institute of Animal Pathology, Cambridge, for carrying out the agglutination tests against *Br. abortus*.

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CLINICAL COMMUNICATION

Cerebral Babesiosis in Dogs

By

H. S. PURCHASE, PH.D., F.R.C.V.S.

C.V.R.I., Kabete, Kenya

Although cerebral malaria is a well-known clinical entity, canine cerebral babesiosis, a condition probably analogous to cerebral malaria in man, is not so frequently mentioned in veterinary literature. Whilst examining brains for rabies diagnosis, the author has met this condition in three dogs during the last five years. The common piroplasm affecting dogs in Kenya is *B. canis* although *B. gibsoni* has on a few occasions been suspected, usually mixed with *B. canis*.

One case of cerebral babesiosis, which was brought alive to the laboratory in a comatose state, had a temperature of 102° F. and the parasites were very rare in the blood although numerous in brain sections.

In brain sections the parasites can be seen filling the lumen of small capillaries and small arterioles where they are nearly all extra-cellular, lying free in the vessels. Not every vessel contains parasites and the distribution throughout the brain matrix is uneven. There appears to be no cellular reaction to the parasites by either the vessels or brain tissue.

The last specimen of this condition was received from a known rabies area and the field officer's remarks were: "There is very little known of this pup's history. It was playing with some children on the tenth when it bit the owner's son in the ear. The owner was away until the 14th and on his return the same day was informed the puppy was dead. From enquiries made the puppy was normal but slightly off its feed."

No evidence of rabies was found in sections of the *hippocampus* or *cerebellum* but vessels packed with *B. canis* parasites were present in both tissues. Fig. 1 shows clearly the nature of the parasitic congestion in the lumen of a small vessel of the *cerebrum* whilst Fig. 2 demonstrates not only the distribution and extra-cellular position of the parasites, but also their piriform shapes. The parasites appear to be *B. canis*, their shape and size being normal for this species, but the nuclear mass in all these extra-

cellular parasites is central, a fact reminiscent of the nuclear position as found in the toxoplasmata.

I am indebted to Mr. W. P. Langridge for the photographs.

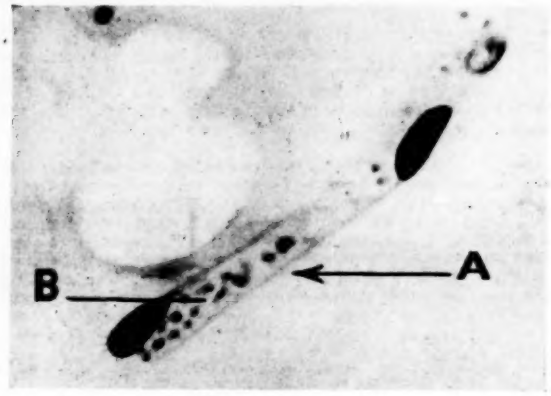

FIG. I.

A OUTLINE OF VESSEL WALL
B PARASITES

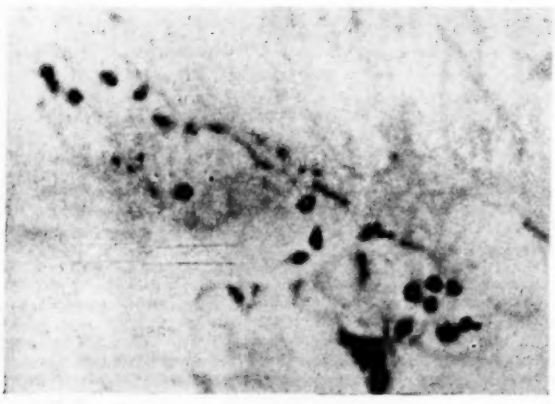

FIG. II.

CONTROL OF PROPRIETARY MEDICINES

In a report to the Minister of Health, based on a five-year survey, the Pharmaceutical Society suggests that the public's demand for proprietary medicines will not grow less under the new comprehensive medical service. The right to self-medication is not denied, but the public should, it is held, be protected; for otherwise "the era of a comprehensive health service may bring with it the golden age for commercialized charlatanism, which makes a butt of the orthodox practitioners on whom the service depends and a victim of the public to the prejudice of the service." Among the society's recommendations are: that the maintenance of proper standards for proprietary medicines and for their advertisement should be a statutory duty of the Minister of Health in England and of the Secretary of State in Scotland, who would be assisted by an expert advisory committee; that a register of medicines and manufacturers should be kept and the sale of unregistered medicines prohibited; that standards for medicines and advertisements, to be prescribed by regulations, should include requirements for the disclosure of composition in approved words and quantities, and for the prohibition of false, misleading, or exaggerated claims, and of offers of postal diagnosis; and that complaints of non-compliance with the regulations should be heard by the committee, who would advise the Minister whether the medicine or the manufacturer should remain on the register, any action by the Minister being subject to appeal to the High Court.

THE VETERINARY RECORD
May 31st, 1947

The Minister of Agriculture and his Veterinary Staff

IN the second Report of the Committee on Veterinary Education a letter from the then Minister of Agriculture (Mr. Robert Hudson) was reproduced which contained the following passage:—

> "The Government . . . are satisfied that . . . not only is a better and in fact the best possible training for the veterinarians of the future of vital importance to agriculture, but also numbers substantially greater than exist at present or have hitherto been envisaged will be required for the efficiency and well-being of the livestock branch of the industry."

The Minister was speaking, of course, for a coalition Government in which all the major political parties were represented, so his words carry added weight. When these words were written, Mr. Tom Williams was Parliamentary Secretary to the Ministry of Agriculture under Mr. Hudson, and it can safely be assumed, therefore, that he was in complete agreement with his chief at the time. Since he became Minister himself, Mr. Williams has spoken frequently on the subject of long-term policy, and there can be no doubt about the importance which he attaches to the existence of a flourishing livestock industry.

The need for securing a healthy and well-balanced British agriculture is accepted by all the political parties. Under existing and prospective world economic conditions a prosperous countryside will provide a market of enormous value for the products of our urban factories and workshops, and in so doing will make a great contribution to the competitive power of our manufacturers in markets overseas.

If, then, a flourishing livestock industry is to be regarded as the principal factor in a flourishing agriculture, it is just impossible to understand why Mr. Tom Williams should have been persuaded to pursue a policy of writing-down the status of the veterinary profession. Practising veterinarians know the enormous job of work which lies in front of them if a serious effort is to be made to cut down the gigantic figures of the animal losses due to animal diseases. They have, through the Association, taken the lead during the war in providing more regular veterinary service and advice to farmers by means of the Scheme for the Control of Dairy Cattle. They know, too, that no campaign for the promotion of animal health can succeed without the support of widely extended research services. They themselves have taken the lead in creating an organization which will help to provide these services and to recruit the skilled personnel required to man them.

Mr. Tom Williams' attitude in a nutshell appears to be: I agree with your policy of self-help. I admit that you can make an enormous contribution to the advancement of the livestock industry. But I am not going to lift a finger to raise the status of the veterinary profession, and if the scale of salaries offered to veterinary officers of my Ministry prejudices the Animal Health Division and acts as a deterrent to would-be entrants to the profession, I am sorry, but I am unconcerned.

Many months have passed since Mr. Williams was

persuaded to take up that attitude and, unfortunately, there is no sign that he is ready to recede from it. In the meantime antagonism to his policy has spread and it is doing growing harm to the best interests of the livestock industry and, consequently, to agriculture as a whole and to the national interest.

It is unfortunate in the last degree that such a situation should have been permitted to come into existence. The responsibility for it rests with the Minister and with the Minister alone. So long as he allows it to continue, the N.V.M.A. has no option but to exhaust every means of focusing public attention on the issues at stake.

The facts of the position must be made known to members of both Houses of Parliament, very few of whom are aware of the full significance of the Minister's decree. They must be made known through the columns of the daily and weekly newspapers to the general public, whose interest in the matter is undoubted. And they must be made known, in particular, to the great agricultural community so that full-scale support may be mobilized in furtherance of efforts to persuade the Minister to think again.

In fastening responsibility upon the Minister for a situation which should never have arisen, we have no desire to question in any way the sincerity of his zeal for the agricultural cause. We share with farmers their belief in his honesty of purpose and in his genuine desire to further the best interests of the countryside. The whole trouble, presumably, is that Mr. Williams, in coming down so heavily against proposals for improving the status of the veterinary profession, neglected to appreciate the strength of the case for these proposals, and did not realize the bearing of his decision on his long-term livestock policy.

Statement Regarding the Minister of Agriculture and his Veterinary Staff

The following statement has been issued to the Press by the N.V.M.A.:

When the Ministry of Agriculture in 1938 took over from the County Councils responsibility for much of their work in connection with animal diseases, the change involved the transference of County veterinary officers to the staff of the Ministry's Animal Health Division. It became necessary, as a result, to fix a scale of salaries applicable to these appointments and efforts were made by the National Veterinary Medical Association to secure agreement upon a scale for all posts, up to and including that of the Ministry's Chief Veterinary Officer, which would be consistent with the heavy responsibilities falling upon the professional staff under the new policy relating to livestock improvement and the promotion of animal health.

The Association's efforts were unsuccessful at that time and a salary scale was imposed by the Ministry of Agriculture, the Association agreeing not to embarrass the Ministry by continued opposition in view of the implied animal health programme which was to be undertaken as a result of the Agriculture Act, 1937. It was also understood that a review of the imposed scales would be made within a short time. No such review took place until recently when fresh proposals were put forward by the Ministry and consultations continuing over the last two years carried out between the Association of Veterinary Inspectors (Ministry of Agriculture and Fisheries) and, later, the N.V.M.A. Unfortunately these negotiations did not result in agreement and the present Minister of Agriculture, Mr. Tom Williams, has imposed a salary scale which has met with the vigorous opposition of the veterinary profession. So strong was the feeling on the subject that last year the N.V.M.A. decided to exclude from its official organ all advertisements relating to official veterinary appointments.

A leading article in the Association's journal of May 24th, reveals that the ban has now been withdrawn, but makes it clear that such advertisements will be published free of charge and that the Association will continue to inform its members of its disapproval of the salary scale.

May 20th, 1947

The Secretary,
Ministry of Agriculture and Fisheries,
55, Whitehall,
S.W.1.

Sir,

I have been instructed to inform you that a Special Meeting of Council of the N.V.M.A. was held in London on Thursday, May 8th, and the following resolution was passed:—

"That this Council withdraws its refusal to accept from the Ministry of Agriculture and Fisheries advertisements for official veterinary appointments to the Animal Health Division for publication in *The Veterinary Record* and authorizes their insertion free of charge.

The Council reiterates its strong protest against the inadequate salary scales imposed, which are unacceptable, and intimates to the Ministry of Agriculture and Fisheries that its views on the position will continue to be conveyed to members of the Association, particularly when any official advertisements of appointments are published in *The Veterinary Record* or other journals."

I am, Sir,
Your obedient Servant,
F. Knight,
General Secretary.

The article also discloses that a recent deputation from the Parliamentary and Scientific Committee learned that "there was no inherent difficulty in the Treasury agreeing to improvements in the salary scales if a sufficiently strong case was put to them" and that it had been conceded that pressure for "an improvement in the proposed salaries" would be justified if the Ministry's advertisements attracted "an insufficient number of applications."

In face of such a position, it is difficult to understand why the impasse which has now existed for several months should be permitted to continue. The profession is obviously anxious to collaborate wholeheartedly with the Minister in the development of his livestock programme, but the Minister declines to reach agreement with the N.V.M.A. on the salaries and status of his professional staff. It is greatly to be hoped that he will speedily take steps to end a situation which is doing growing harm to the work of the Animal Health Division of his Department.

NEW INSTRUMENTS AND APPLIANCES

[The Editorial Committee desires to make this Section a regular feature of *The Veterinary Record* and would welcome contributions accordingly. Their publication, however, carries no implication that the instrument or appliance concerned is necessarily recommended by the Committee.]

. . . . . .

A Colt Catcher

H. C. SWANN, M.R.C.V.S.
King's Lynn

With the shortage of skilled help on farms much time is frequently wasted by the veterinary surgeon in attempts to secure unbroken colts or young cattle not previously handled. If one has not accomplished the art of lassooing, such animals may be quickly roped by the use of a colt catcher illustrated in the accompanying diagram.

This appliance consists of three tubular iron rods 3 feet in length, to the end of which is fixed a blunter end U-shaped piece of iron the exact diameter of the halter rope. When screwed together a rod ten feet long is formed, care having been taken to ensure that the diameter of the iron is such that the complete rod will not be too whippy or too heavy to handle with one hand. The poll piece of the halter, which should be of an adjustable type, is then fixed in the U end, and if the animal is crowded into a corner of a loose box or small yard it will soon be found to be comparatively simple quickly to halter the animal required by securing the poll piece of the halter behind the ears, and allowing the widened nose-band of the halter to fall over the muzzle when the animal drops its head.

In the case of cattle or very troublesome colts, an ordinary head rope may be quickly applied over the head and round the neck.

The advantages of this appliance are its simple construction, and its portable nature when not assembled.

Questions and Answers

The submission of questions for inclusion in this column will be welcomed: they can relate to any aspect of veterinary work. For purposes of record, each question is numbered, and those submitting questions are required to furnish (not for publication) name and address.

Answers to readers' queries represent exclusively the personal opinions of the writers, and criticism of the replies will be appreciated.

All communications should be addressed to the Editor.

Diagnosis of Ringworm

Q. CCIII.—*Is the Wood's glass used in conjunction with the ultra-violet ray lamp a certain method of diagnosing ringworm in the dog and cat?*

What is the exact procedure?

A.—Wood's glass in conjunction with an ultra-violet ray lamp is used for diagnosis of one type of ringworm only, namely microsporosis. It is a most useful diagnostic aid but should always be checked by microscopic examination. This check is necessary in view of the fact that fluorescence may be noted in the case of certain types of normal hair, particularly white and brindle. Fluorescence due to microsporosis is yellowish green, while that from other causes is generally whitish purple. The process is, of course, conducted in a dark room

The procedure is detailed fully in the article by J. W. H. Holmes, "Clinical Laboratory Methods for Use in the Diagnosis of Animal Skin Diseases," published in the October 8th, 1938, issue of *The Veterinary Record* (**50**. 1331-1335).

. . . . . .

Depilation in Cats

Q. CCIV.—(a) *Will you please discuss the causes, and suggest a line of treatment for loss of hair in cats? This conditon is non-parasitic and is frequently met with in long-haired Persian types, also in neutered males and females of any type. The hair becomes soft and silky, thinly spaced, and breaks off short.*

(b) *Cats fed on an exclusive fish diet frequently show skin eruptions and loss of hair. What is the best diet or treatment for these animals?*

A.—In the writer's opinion both the skin conditions described by the questioner are basically the same, but in the latter case, when actual eruptions are present, secondary infection of the denuded areas has occurred.

This condition has been ascribed to several causes, one being, as suggested, an exclusive fish diet, whilst many clinicians consider the condition to be confined to neutered cats and thus probably of hormone origin. Neither of these causes covers all cases in the writer's experience. During the war years a large number of these cases has been encountered in cats on widely varying diets, few of which were exclusively or even mainly fish-fed. Equally a number of cases has been met in adult tom and female cats.

No entirely satisfactory treatment has been evolved, but in the writer's hands the most consistent results have been obtained by the administration of the vitamin H preparation Murnil (Bayer), at the rate of at least one teaspoonful in the food daily. This treatment needs perseverance over long periods and relapse may follow cessation of treatment; some cases also show seasonal recurrence. In cases complicated by secondary pustules or papular eruptions local treatment of lesions is necessary; gentian violet or triple dye preparations have proved best, but good results have also followed the use of organic sulphur preparations or gammexane in certain cases.

In some obstinate cases, on the assumption that hormonal upset may be the cause, stilboestrol has been used with varying success; some cases have shown spectacular improvement. Obviously testosterone is the hormone of choice in neutered males, but its prohibitive cost usually makes this impossible, hence stilboestrol has been tried. One unforeseen and unfortunate side effect in one case was that treatment rendered a neutered male attractive to neighbouring toms!

The condition is undoubtedly a puzzling one and the success achieved with the use of Murnil does suggest that the cause is probably dietetic; in all cases presented for treatment diet is considered and a mixed diet prescribed in preference to all-fish feeding. In cases where meat cannot be obtained white fish should be replaced by the oily fish, such as herring, pilchard or mackerel. Liver should also be included whenever possible.

. . . . . .

Terms of Partnership

Q. CCV.—*What basis is used in computing the cost of a partnership in a veterinary practice? Are instruments and drugs taken as a separate valuation? What are the usual points in drawing up a partnership agreement?*

A.—The basis for computing the purchase price to an incoming partner will be similar to that used on the sale of a practice. The parties agree to use either gross turnover or net profit for the purpose of valuation; in the former case the figure will be in general an average of the three preceding years, and in the latter two or even three years purchase, *e.g.*, where the net profit is £1.000 the figure will be £2,000 or £3,000. Naturally the incoming partner pays for his share according to whether, for example, it is to be 33⅓ per cent., 40 per cent. or 50 per cent.

It is customary for instruments and drugs to be valued separately, and for an inventory to be prepared which can be used to record additional capital expenditure during the life of the partnership, and to assist in "winding up" the business if the partnership is determined at a later date.

A partnership agreement should always be drawn up by a solicitor, and *it is wisest for both parties to appoint their own solicitor* so that the finer points of law can be fought out on their behalf by persons understanding the intricacies of partnership law. Providing that the intending partners are agreed on the main points—such as who is to be senior partner, the purchase price, division of profits, purchase and maintenance of cars, provision for holidays, an option for the junior partner to purchase outright at an agreed price on the retirement of the senior partner, and as to the procedure to be adopted if the partnership is determined by death or by notice—it is best to place the matter entirely in legal hands and to refrain from further worry!

Negligent drawing up of agreements, "gentlemen's agreements," and the exchange of letters signifying the intention to create a partnership, can all prove extremely costly to one or other of the parties if the business arrangement collapses, as many professional men have discovered. Legal expenses in this connection are well worth incurring.

CORRESPONDENCE

Q. CC.—Toxaemia of Pregnancy

Sir,—There has been an enormous loss in sheep from toxaemia of pregnancy this year, a lot of which could have been avoided had the farmers consulted a veterinary surgeon in the early stages. Many sheep that were suffering from this disease were being treated by their owners with various kinds of eye lotions, thinking that the sheep had "snow blindness."

In my opinion the best treatment for pregnancy toxaemia is glucose and insulin injected into the sheep as early as possible, a second injection being given if necessary. Those that do not respond to the second injection are best slaughtered immediately, as it is very probable that they have dead lambs inside them, and further treatment will be useless.

Yours faithfully,

Eastwick House, Evesham, Worcs. G. C. LANCASTER.
May 11th, 1947.

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Q. CCI.—Foot-rot in Sheep

Sir,—In my opinion the best treatment for foot-rot in sheep is, without doubt, a vaccine of the organism *Fusiformis necrophorus*. It will cure over 90 per cent. of the cases, 50 per cent. of which require only one injection. Where the sheep have no wounds, other treatment to the feet is unnecessary, otherwise a solution of aloes, spirit and linseed oil is recommended. I was more than surprised to read in the N.V.M.A. publication on Diseases of Sheep that the recommended treatment was copper sulphate.

Whilst discussing feet may I say that a couple of doses of bovine pyaemic vaccine, with a little liniment applied to the coronet, will cure most cases of foul in the feet in cattle. I have cured cases of quittor in horses with vaccines, plus a little superficial dressing of whatever I deemed advisable at the time.

Yours faithfully,

Eastwick House, Evesham, Worcs. G. C. LANCASTER.
May 11th, 1947.

ABSTRACTS

[Factors Influencing Ascites in Patients with Cirrhosis of the Liver. RALLI, E. P., *et al.* (1945.) *J. clin. Invest.* **24** (3). 316-325.]

Observations on the plasma levels of albumin in human patients with cirrhosis of the liver suggested that the occurrence of ascites in such patients was not determined solely by a fall of plasma albumin below a critical level, or by the diminished oncotic pressure thereby exerted. For example, plasma albumin levels were low in patients with cirrhosis of the liver, whether or not ascites was present, and the level remained low even in patients in which the reaccumulation of fluid after paracentesis was prevented by dietary treatment and injections of liver extracts.

An examination of the urine of patients with cirrhosis showed it to have an antidiuretic effect when tested in rats, and there appeared to be some correlation between the degree of ascites and the antidiuretic activity of the urine. The cause of this effect was not determined, but it is suggested that it might be due to the presence in the urine of a hormone of posterior pituitary origin that is normally inactivated in the liver. It seemed probable that, in patients with cirrhosis but without ascites, the liver was still capable of inactivating this substance, whereas it had lost this function in patients with ascites.

E. C.

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[Studies in Louping-Ill. I—Cultivation of Louping-Ill Virus *in vitro*. **II—Pathogenic Properties of Culture Virus.** WILSON, D. R. (1945.) *J. comp. Path.* **55**. 250-267.]

These two papers give a detailed description of some of the author's work in determining whether tissue culture-virus could be used as an efficient substitute for sheep tissue-virus in the production of louping-ill vaccine. Using a medium consisting of minced viable chick embryo tissue in Tyrode's solution, or in a mixture of Tyrode's solution and sheep serum, the virus was successfully grown *in vitro* and by the use of cultures of from two to 14 litres large amounts of virus were obtained. Observations on the growth requirements of the virus showed that conditions favourable for multiplication occurred in the range of *p*H 7 to *p*H 9 and the optimum ratio of chick embryo tissue to the fluid portion of the medium lay between 1:100 and 1:33. The medium never failed to detect very small quantities of virus in dilutions infective for only a proportion of mice inoculated intracerebrally and in some instances test amounts of virus were only detected by inoculation of the medium, incubation and subinoculation of mice.

A study, using sheep, of the pathogenic properties of the culture-virus showed that 170 serial passages *in vitro* had not modified its pathogenic character or its antigenic structure.

W. M. M.

The Single Intradermal Comparative Test

As readers will have learned from last weeks' issue of the *Record*, the single intradermal comparative test will be introduced on June 2nd, 1947, for all official tuberculin tests. For all herd tests, and tests of individual animals to be added to a herd, P.P.D. "Herd Test" tuberculin (Mammalian 3 mg. per c.c., Avian 0·8 mg. per c.c.) will be used. Only one injection of each tuberculin is given. The dose in each case is 0·1 c.c. One post-injection observation only is necessary, at the 72nd hour. For the retesting of animals which give an inconclusive reaction, "Retest Strength" tuberculin (Mammalian 1·5 mg. per c.c., Avian 0·4 mg. per c.c.), will be used; one post-injection observation only is made (at the 72nd hour) unless in the judgment of the operator a further observation at the 96th hour would be of value. "Retest Strength" tuberculin is the same strength of tuberculin as is used at present for the double intradermal test.

Supplies of tuberculin for the single intradermal test will be obtainable by veterinary surgeons from the Ministry's Veterinary Laboratory, New Haw, Weybridge, Surrey, on and after June 2nd, in 5 c.c., 3 c.c. and 1 c.c. bottles at a charge of one shilling per 1 c.c. In ordering supplies, care must be taken to specify "Herd Test" tuberculin where the double-strength tuberculin (*i.e.*, Mammalian 3 mg. per c.c., Avian 0·8 mg. per c.c.) is required, and "Retest Strength" tuberculin in the case of single-strength tuberculin (*i.e.*, Mammalian 1·5 mg. per c.c., Avian 0·4 mg. per c.c.).

The following notes on the single intradermal comparative test with Weybridge tuberculins and the method of interpretation adopted by the Ministry are appended for the information of all veterinary surgeons concerned in the application of the test and particularly of those veterinary surgeons who may wish to carry out this test in their private practices:—

(1) In these notes, the term "doubtful" is used to describe the reaction to an injection of tuberculin which is neither positive nor negative. "Inconclusive" is used to describe the result of a comparative test where the reaction, history, etc., have not enabled a definite opinion to be formed as to the type of infection causing the reaction.

(2) The site of the injection of tuberculin is of great importance, particularly in the comparative test. Injections close to the shoulder give markedly poorer reactions than in sites nearer the head, so that unless the two tuberculins are injected in equally favourable sites, the variation in the reactions due to site may be such as to invalidate the normal basis of interpretation. If the injections are made on the same side of the neck, they must be made equidistant from the point of the shoulder and in the middle third of the neck and at least five inches apart.

(3) When Weybridge tuberculin is used, any swelling showing diffusion, irrespective of increase in skin measurement, should be regarded as a positive reaction. When the swelling shows no diffusion, the reaction to the single intradermal test should be regarded as negative when the increase in measurement is 2 mm. or less, as doubtful with an increase of 3 mm., and as positive with an increase of 4 mm. or more.

(4) An animal giving a negative reaction to mammalian tuberculin and a positive reaction to avian must be regarded as infected with a non-specific infection. Such a reaction can be accepted as evidence of the existence of a non-specific infection in the herd, evidence which has a definite bearing on the interpretation of other reactions. It is, however, not infrequently found that such evidence of non-specific infection may be confined to one age-group—usually, but by no means always, the young stock—with the result that in such cases a different standard of interpretation is applicable to the other age groups. Clinical evidence of Johne's disease or of "skin tuberculosis" should also be regarded as establishing the existence of non-specific infection.

(5) If the presence of non-specific infection within an age-group has been established:—

(*a*) Animals which show a positive or doubtful reaction to avian tuberculin and a positive or doubtful reaction to mammalian tuberculin, and in which the mammalian reaction is not greater than the avian by more than 4 mm., should be regarded as infected with non-specific infection and be retained.

(*b*) Where the excess to mammalian tuberculin is 5 mm.

or 6 mm. the animal should be retested. Animals showing positive mammalian, negative avian reactions may be retested if the mammalian reaction is 6 mm. or less in excess of the avian reaction. Animals showing doubtful mammalian, negative avian reactions should always be retested.

(*c*) Where the excess in the reaction to mammalian tuberculin is more than 6 mm. the animal should normally be regarded as infected with bovine tuberculosis and be removed. This applies also to animals with positive mammalian, negative avian reactions.

(6) Where definite evidence of non-specific infection in a herd or age-group has *not* been established:—

(*a*) Animals which show a positive or doubtful reaction to avian tuberculin and a positive or doubtful reaction to mammalian tuberculin, should be retested when the reaction to mammalian tuberculin does not exceed the avian by more than 4 mm.; other reactors to both tuberculins must be regarded as infected with bovine tuberculosis.

(*b*) Animals showing positive mammalian, negative avian, reactions are normally regarded as being infected with bovine tuberculosis.

(*c*) Animals showing doubtful mammalian, negative avian, reactions should always be retested.

(7) Retests should be carried out not less than one month after the preceding test, and in assessing the results of retests of inconclusive reactors regard should be had to the responses at the two tests; non-specific reactors usually show a lessened response to mammalian tuberculin and not infrequently—though less consistently—an increased avian reaction.

(8) This system of interpretation is intended for application to tests of herds. It can also be applied to groups of cattle which have come from one source. Tests of single animals and collections of animals from different sources must be interpreted on the basis that non-specific infection has not been established, as in paragraph (6).

As the criteria applicable in the case of a herd test cannot be applied in interpreting the comparative test of single animals, such animals which are to be tested for entry to sales should be tested sufficiently early to allow of a retest being carried out, should such prove necessary, before the date of the sale or the closing of entries as the case requires. In retesting such animals it may facilitate interpretation to test at the same time a few animals in the same age-group as controls, if this is practicable.

In testing herds with tuberculin for the first time many practitioners may wish to use mammalian tuberculin only. For the initial test of a herd, especially if its history suggests that it is definitely infected with bovine tuberculosis, a test with mammalian tuberculin only has much to recommend it.

If, however, the single intradermal comparative test is used for the first test of a herd, it is advisable that the test should be assessed separately in each group of animals. If the test and/or clinical examination indicates that there are several animals infected with bovine type tuberculosis in a group, all animals in the group which show a greater reaction to mammalian tuberculin should be removed from the herd and all other reactors to mammalian tuberculin should be retested before they are accepted as free from infection. In groups showing a high incidence of non-specific infection the normal method of interpretation of the comparative test should be followed.

MIGRATIONS OF SALMON

The Ministry of Agriculture and Fisheries is to take part in an investigation of the migrations of salmon, instituted by the International Council for the Exploration of the Sea. A number of adult salmon and sea trout will be marked in the North Sea off the mouth of the Yorkshire Esk during this month and in June, July and August. Fish will be caught and released alive after a distinctive mark, consisting of a small celluloid tube containing a slip of paper with instructions as to return of marks, has been attached to the dorsal fin by a loop of silver wire. It is expected that a proportion of these marked fish will be recaptured, and salmon fishermen at all stations are invited to co-operate in the scheme by sending particulars of any recaptures to the Fisheries Department of the Ministry, who will pay a reward of 5s. for complete particulars.

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Weekly Wisdom

Mr. Leslie Henson . . . carrying his bowler hat through the centuries with the long-suffering expression of the common man who is always wondering what the great ones have done for him but cannot altogether repress the dream of a "merrie England."—"Times" notice of "1066 and All That" (Saville Theatre).

NOTES AND NEWS

Diary of Events

May 31st.—Meeting of the Nutrition Society in the Barnes Hall of the Royal Society of Medicine, 1, Wimpole Street, W.1: Scientific Meeting 10.30 a.m.; Annual Meeting 2 p.m.

June 3rd.—R.C.V.S. Annual General Meeting.

June 3rd and 4th.—R.C.V.S. Committee Meetings.

June 3rd.—V.V.B.F. Annual General Meeting.

June 5th.—R.C.V.S. Committee and Council Meetings.

June 5th.—Central Veterinary Society Visits Lady Wentworth's Arab Stud at Crawley and Mr. E. G. Langford's farm at Lingfield. (See Notice.)

June 6th.—Quarterly Meeting of the South Wales Division, N.V.M.A., at the Zoology Department, University College of Wales, Cambrian Street, Aberystwyth, 2.15 p.m.

June 7th.—Meeting of the Biochemical Society at the Medical School, Hospitals Centre, Birmingham, 15, at 1.30 p.m.

June 11th.—Meeting of the Editorial Committee, N.V.M.A., at 36, Gordon Square, W.C.1, 2.30 p.m. (Abstracts Sub-committee, 1.45 p.m.)

June 11th.—Summer Meeting of the Lancashire Division, N.V.M.A., at Chester. (See Notice.)

June 12th.—Meeting of the Central Veterinary Society at the Royal Veterinary College, N.W.1, 2 p.m.

June 13th.—R.A.V.C. Annual Dinner, Grosvenor House, London.

June 18th and 19th.—N.V.M.A. Committee Meetings, 36, Gordon Square, W.C.1.

June 19th.—Meeting of the Western Counties Division, N.V.M.A., at Dartington Hall, Totnes, 2 p.m.

June 20th.—N.V.M.A. **Council Meeting,** at the Connaught Rooms, Great Queen Street, Kingsway, W.C.2.

June 25th.—Meeting of the South-Eastern Division, N.V.M.A., at Frant, Nr. Tunbridge Wells (The Wellcome Veterinary Research Station), 11 a.m.

June 26th and 27th.—R.C.V.S. Written Examinations.

July 28th—Aug. 1st.—N.V.M.A. Annual Congress in Edinburgh.

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Fees Paid by the Ministry of Agriculture for Part-time Work

We reproduce below, as a matter of general interest, a letter that has been received from the Ministry of Agriculture:—

Ministry of Agriculture and Fisheries,
23-25, Soho Square,
London, W.1.

May 17th, 1947.

Dear Mr. Knight,

VETERINARY SURGEONS' FEES

The representations made by the representatives of your Association at the meeting here on May 2nd for an increase in the fees paid by the Ministry to Local Veterinary Inspectors have been considered, and I am happy to be able to inform you that the proposals made by the representatives of your Association have been accepted by the Ministry.

These proposals were as follows:—

(*a*) An overall increase of one-third in the Local Veterinary Inspectors' fees and the fees for special duties;

(*b*) An increase to £6 6s. of the present daily maximum fee of £4 4s.;

(*c*) An increase to 7½ guineas of the present daily maximum fee of 5 guineas for the examination of stallions.

The Ministry proposes to make the new rates operative on June 1st, 1947.

Yours sincerely,
C. T. HOUGHTON.

F. Knight, Esq.,
National Veterinary Medical Association
of Great Britain and Ireland.

Ministry of Agriculture—Veterinary Appointments

Resolution passed at Meeting of Eastern Counties Division held on May 21st

"The Eastern Counties Veterinary Society strongly supports the Council of the N.V.M.A. in its efforts to obtain improved status and salaries for the whole-time veterinary officers of the Animal Health Division of the Ministry of Agriculture and Fisheries and urges it to continue to make every effort in its power. This Society fully realizes the great importance of an efficient and contented official veterinary service in future developments of animal health and livestock improvement plans which are so urgently required."

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N.V.M.A. Congress, Edinburgh

The programme of the Association's Edinburgh Congress which appears on page 276 of this issue shows that the activities of the Congress are equally balanced between business affairs and social occasions and so far as the latter are concerned, the Provisional Committee would, in view of the limits set by caterers, strongly urge members to make immediate use of the Ticket Sheet published on advertisement page 10 to apply for tickets for the functions, excursions, etc., in which the wish to share.

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Oversea Veterinary Appointments

The N.V.M.A. for some time past has been endeavouring to persuade certain oversea Government authorities to improve the conditions of service for veterinary officers. In some it has been unsuccessful up to the present and certain oversea Governments may have decided to advertise for veterinary officers in the lay press and elsewhere; these advertisements may appear at any time.

It is suggested that any members of the N.V.M.A., seeing such advertisements and being interested should communicate with the General Secretary, N.V.M.A., 36, Gordon Square, W.C.1. An explanation will then be given of the reasons which have caused the Association to decline to accept advertisements of these posts for insertion in *The Veterinary Record*.

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Children's Visit to Denmark

Through its President, Dr. N. Plum, the Danish Veterinary Association has once again extended an invitation, *via* this Association, to the children of British veterinary surgeons to visit Denmark during the summer holidays and has, in fact, already sent a list of Danish veterinary surgeons who would like to be their hosts. In view of the success of last year's visit, the N.V.M.A. has accepted this kind offer and the General Secretary would be pleased to hear from any members who would like their children to go. Arrangements can again be made through Cook's, but there is some urgency in the matter of fixing travelling facilities and those interested are asked to write in to the Association without delay.

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PERSONAL

Birth.—Wight.—On May 9th, 1947, at Sunnyside Nursing Home, Thirsk, to Joan, wife of J. A. Wight, M.R.C.V.S., a sister for Jimmy.

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R.C.V.S. OBITUARY

Williams, Hugh, M.R.C.V.S., Bodrwnsiwn, Tycroes, Anglesey. Graduated Glasgow, April 18th, 1887. Died May 16th, 1947; aged 81 years.

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R.C.V.S. ANIMAL MANAGEMENT EXAMINATION

List of Successful Candidates

(*Continued from page* 263)

Dublin:

Burke, K. N. M.
Lawther, S. McK. (Credit).
Lyne, J. K.
McGlinchey, D. E.
Taaffe, G. F.
Thornton, I. M. (Credit).

ADDRESSES OF DISEASE-INFECTED PREMISES

The list given below indicates, first, the count, in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Sheep Scab:

Denbigh.—Park Farm, Rhosymadoc, Ruabon, Wrexham, Denbighshire (May 19th).

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In the official milk records for British goats some 229 gave yields of over 2,000 lb., nine between 4,000 lb. and 5,000 lb. and two over 5,380 lb.

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the N.V.M.A.

Correspondents should write as briefly as possible and letters should not exceed 350 words.

CHILDREN'S HOLIDAY EXCHANGES IN FRANCE AND BRITAIN

The approach of summer prompts us to ask the hospitality of your columns for a renewal of our suggestion that the children of members practising in Great Britain will be most welcome in the homes of French practitioners during the summer holidays.

We also desire to place some French boys and girls in congenial surroundings for a week or two and shall be most grateful for any offers of hospitality.

In view of the fact that visas for travel to France are now no longer necessary, may we urge members seriously to consider sending their children to selected families abroad, and we guarantee to see that this will be a memorable occasion for them.

Will members please communicate with either of the undersigned as quickly as possible.

Yours faithfully,
T. J. Tyrrell
(Divisional Inspector, Ministry of Agriculture),
44, East Street,
Chichester.

John Pasfield,
Shelley House,
Bishopric,
Horsham

For the Sussex Division, N.V.M.A.
May 21st, 1947.

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THE R.A.V.C. CLUB

Sir,—I shall be grateful if you would be good enough to afford me the space to bring to the notice of Members of the Profession the activities of the R.A.V.C. Club.

During the war years we have been unable to hold any of the usual social functions, and it is probable that many who joined the Forces during the emergency are unaware of the existence of the Club.

Membership is open to all officers of the R.A.V.C. past and present, the annual subscription for retired officers being half a guinea and for serving officers half a day's pay of their rank. Membership of the Club also confers membership of the R.A.V.C. Point to Point Association and the R.A.V.C. Golfing Society. As already announced in your columns, we are organizing the annual Officers' Dinner once again on June 13th, at Grosvenor House.

I shall be pleased to give any further information if intending members will write to me.

I am, Sir,
Yours faithfully,
D. A. Green (Lt-Col.),
Hon. Sec. and Treas., R.A.V.C. Club

The War Office,
Droitwich Spa,
Worcestershire.
May 15th, 1947.

EDINBURGH CONGRESS, 1947

The following is the Programme of the Association's Congress to be held at the Royal (Dick) Veterinary College, Summerhall Square, Edinburgh, 9, from July 27th to August 1st (inclusive), except where otherwise stated.

SUNDAY, JULY 27TH

7.30 p.m. to 9.30 p.m.	Reception by Scottish Metropolitan Division in Royal (Dick) Veterinary College.

MONDAY, JULY 28TH

10.30 a.m.	Opening of Congress by Rt. Hon. Sir J. I Falconer, Lord Provost of Edinburgh.
11 a.m.	Opening of Exhibition of Drugs and Surgical Instruments, etc., by President, N.V.M.A.
11.30 a.m.	Council Meeting.
2 p.m.	Paper: "Toxicological Problems in Veterinary Practice." By G. F. Boddie, B.SC., M.R.C.V.S., F.R.S.E. Openers of discussion: H. H. Green, D.SC., and T. M. Mitchell, M.R.C.V.S., D.V.S.M. Chairman: J. N. Ritchie, B.SC., M.R.C.V.S., D.V.S.M. Recording Secretary: J. S. S. Inglis, B.SC., M.R.C.V.S.
2 p.m.	Ladies' Outing to Zoological Gardens.
8 p.m. to 1 a.m. ..	President's Reception and Dance (Freemasons' Hall, 96, George Street, Edinburgh, 2).

TUESDAY, JULY 29TH

9.30 a.m.	Paper: "Retention of the Placenta in the Bovine." By A. J. Kennedy, B.SC., M.R.C.V.S. Openers of discussion: A. S. Chapman, M.R.C.V.S., and J. M. Rorrison, M.R.C.V.S. Chairman: R. W. Johnston, M.R.C.V.S. Recording Secretary: A. Thomson, M.R.C.V.S.
11 a.m.	V.V.B.F. Ladies' Guild Annual General Meeting.
2 p.m.	Visit to Laboratories of the Animal Diseases Research Association, Moredun Institute, Gilmerton, or to Corporation Markets and Slaughter-house, Gorgie, Edinburgh.
7.30 p.m.	Civic Reception by the Corporation of the City of Edinburgh. (City Chambers, High Street, Edinburgh.)

WEDNESDAY, JULY 30TH

9.30 a.m.	Paper: "The Immunology and Epidemiology of Virus Diseases." By M. Crawford, M.R.C.V.S. Openers of discussion: I. A. Galloway, D.SC., M.R.C.V.S., and D. R. Wilson, D.SC., M.R.C.V.S., D.V.S.M., F.R.S.E. Chairman: D. C. Matheson, M.R.C.V.S., D.V.S.M., F.R.S.E. Recording Secretary: J. W. Emslie, B.SC., M.R.C.V.S.
10 a.m.	Ladies' Golf Tournament at Liberton Golf Course.
1.45 p.m.	Congress Photograph.
2.30 p.m.	Ladies' Outing to Lauriston Castle.
2.30 p.m.	Annual General Meeting.
7.30 p.m. for 8 p.m...	Annual Dinner in Freemasons' Hall.

THURSDAY, JULY 31ST

9.30 a.m.	All-day Excursion to Trossachs.
10 a.m.	All-day Excursion to Borders.
10 a.m.	Men's Golf Tournament at Luffness Golf Course.
8.30 p.m. to 1 a.m. ..	Ladies' Veterinary Benevolent Guild Dance.

FRIDAY, AUGUST 1ST

10 a.m.	Closing Meeting.
11 a.m.	Council Meeting.
2 p.m.	Conducted Tour of Royal Mile, Edinburgh.

Form of application for ticket will be found in advertisement page X.